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1. Objective

- 1.1. This directive is part of the CNS inspector handbook.
- 1.2. This directive provides guidance for evaluating and approving VHF Aeronautical Radio Stations.

2. General

- 2.1. Under article 35(a) to the Israeli Air Navigation Law 2011 any Aeronautical Telecommunication Service is required to have CAAI approval before being established or used.
- 2.2. Aeronautical Radio Station is specifically included in the definition of Aeronautical Telecommunication Service in Article 1 to the ANL, 2011.

Note: The term 'Aeronautical Radio Station' includes the terms Aeronautical Station and Aeronautical Mobile Station for the purposes of this document.

- 2.3. This document sets out the requirements for approval of VHF radio equipment and systems at Aeronautical Radio Stations of the Aeronautical Mobile Service established or used within Israel to provide ATS services.

Note: 'Air Traffic Services (ATS)' means the various flight information services, alerting services, air traffic advisory services and ATC services (area, approach and aerodrome control services). One or more of these services may be employed in the En- Route Communications Network, at Area Control Centers, and Aerodromes

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2.4. This document applies to fixed, stationary, vehicle, portable and hand held equipment categories comprising transmitter, receiver and transceiver equipment types operating in the VHF Aeronautical Mobile (R) Service allocation 118 MHz to 136.975 MHz, using Double Sideband (DSB) Amplitude Modulation (AM) full carrier with 8.33 kHz or 25kHz channel spacing, intended for analogue voice and data link communications.

2.5. Abbreviations

- ANL - Air Navigation Law
- ANR - Air Navigation Regulations
- ATC - Air Traffic Control
- ANS - Air Navigation Service
- ATS - Air Traffic Service
- DOC - Designated Operational Coverage
- SINAD - (Signal + Noise + Distortion) / (Noise + Distortion)
- VDL - VHF Digital Link
- VHF - Very High Frequency

3. Reference Material ,Form& Job-Aids

3.1. Law & Regulation

- 3.1.1. ANL 2011 articles 35(a) & 27(a) & 29
- 3.1.2. ANR Operation of Aircraft and Rules of Flight, 1981 - 66(c).
- 3.1.3. ANR Safety at Aerodromes of the Airport Authority, 1992 - 3.

3.2. CAAI AP

- 3.2.1. AP 1.7.005 / 2.7.005 - ATS equipment installation, maintenance, operation & approval

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3.3. ICAO annexes & documents

- 3.3.1. ICAO Annex 10 Aeronautical Telecommunications
Volume III - Communication Systems Part I - Digital Data
Communication Systems; Part II - Voice Communication
Systems.
- 3.3.2. ICAO Annex 10 Aeronautical Telecommunications
Volume V (Aeronautical Radio Frequency Spectrum
Utilization).
- 3.3.3. ICAO Annex 11 Air Traffic Services.
- 3.3.4. ICAO Doc 11 - EUR Frequency Management Manual
- 3.3.5. ICAO Doc 9712 - Training Manual Part E-2 Air Traffic
Safety Electronics Personnel (ATSEP)

Note: This document incorporates the relevant SARPs from ICAO Annex 10 and Annex 11 together with material from the ITU Radio Regulations.

3.4. Other Documents

- 3.4.1. EUROCAE ED-67 'Minimum Operational Performance
Specification for devices that prevent unintentional or
continuous transmissions' April 1991.

3.5. Forms & Job-Aids – none

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4. Process

4.1. Technical Requirements

4.1.1. Safety objective

The equipment and systems at Aeronautical Radio Stations shall provide complete, identified, accurate and uncorrupted voice and data link communications for Air Traffic Services.

4.1.2. General Requirements

4.1.2.1 The requirements in this section are applicable to equipment and systems at all ATS Aeronautical Radio Stations operating on Aeronautical Mobile (R) Service frequency assignments.

4.1.2.2 The equipment, systems, services and facilities shall comply with the applicable international standards, recommended practices and procedures for ANS in Annex 10 and Annex 11 to the Convention on International Civil Aviation.

4.1.2.3 The equipment, systems, services and facilities shall comply with the applicable Radio Regulations of the International Telecommunications Union.

4.1.3. Radio Spectrum Management

4.1.3.1 The equipment and systems shall be designed and constructed to operate within the Aeronautical Mobile (R) Service allocation 118.000 MHz to 136.975 MHz .

4.1.3.2 For radiotelephony channel spacing is either 25 kHz or 8.33 kHz using Double Sideband (DSB) Amplitude Modulation (AM) full carrier (ITU emission designator 6K80A3EJN and 5K00A3EJN for 8.33 kHz channel spacing).

4.1.3.3 For data link communications channel spacing is 25 kHz using Double Sideband (DSB) Amplitude Modulation (AM) full carrier:

4.1.3.3.1 For ACARS channel spacing is 25 kHz using MSK modulation (ITU emission designator 13K0A2DAN).

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4.1.3.3.2. For VDL Mode 2 channel spacing is 25 kHz using D8PSK modulation (ITU emission designator 14K0G1D)

4.1.3.3.3. For VDL Mode 4 channel spacing is 25 kHz using GFSK modulation (ITU emission designator 13K0F7D).

4.1.3.4 The equipment and systems shall be installed, operated and maintained in compliance with the terms of specific location dependent or general frequency assignment(s) and the terms and conditions of the Approval granted in respect of the ATS being provided.

4.1.3.5 The frequency assignments will be according to table 2.1 in ICAO EUR doc 11.

4.1.3.6 All frequency assignments shall be coordinated and registered in ICAO data base.

4.1.3.7 The frequency assignments may include parameters such as the DOC, minimum field strength within the DOC, maximum field strength outside the DOC and/or minimum and maximum effective radiated power (ERP). These parameters are designed to support reliable communications and to reduce the probability of co-channel or adjacent channel interference to other users.

4.1.3.8 The DOCs associated with the frequency assignments for ATS Communications Facilities and Radio Navigation and Landing Aids at aerodromes, shall be published in the Remarks column of sections AD of the AIP respectively

4.1.3.9 Frequencies for En-route Navigation Facilities shall have their DOCs published in the AIP section ENR under the associated Remarks column.

Note: Aircraft radio transmissions outside of the DOC are a known source of co-channel and adjacent channel interference.

4.1.3.10 Recommendation - On a high percentage of occasions, the effective radiated power should be such as to provide a field strength of a least 75 microvolts per meter (minus 109

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dBW/m²) within the defined operational coverage of the facility, on the basis of free-space propagation (Based on ICAO Annex 10 Aeronautical Telecommunications Volume III paragraph 2.2.1.2. (Power)).

- 4.1.3.11 All Aeronautical Radio Stations shall be suitably licensed by the ministry of communication.
- 4.1.3.12 Failure to renew the ministry of communication radio license will invalidate the associated CAAI Approval and the associated frequency assignment will be withdrawn. Renewal after the withdrawal of the ministry of communication radio license will be treated as a new application.
- 4.1.3.13 For new installations that operate on aeronautical frequency assignments, initial applications to establish an Aeronautical Radio Station shall be made to the CAAI, which will trigger the process with the ministry of communication.
- 4.1.3.14 Inspection of Aeronautical Radio Stations - The equipment and systems at aeronautical radio stations and associated records shall be inspected by CAAI Inspector.
- 4.1.3.15 Demonstration of compliance will be required. This may include measurements to verify transmitter frequency, modulation depth, transmitter output power and a determination of effective radiated power. The ATS Provider is expected to provide this information.

4.1.4. Specific Requirements

4.1.4.1 Communications Availability

- 4.1.4.1.1 Adequate safety assurance, risk assessment and mitigation shall be performed by the Service Provider to ensure that the equipment and system design, installation, operation and maintenance ensures availability of communications appropriate for the Air Traffic Services and environment in which it is being provided.

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4.1.4.1.2. The availability of communications is dependent on the radio system design, including equipment configuration and power supply arrangements. The selection of equipment with the appropriate duty cycle can also reduce equipment failure. The provision of alarm/status indications is also important in ensuring that appropriate actions are taken to restore communications when a failure occurs

4.1.4.2 Radio System Design

4.1.4.2.1. Radio system design includes the consideration of location dependent factors such as a clear radio line of sight, location of antenna, antenna type and transmitter power etc. to ensure reliable radio propagation paths are achieved.

4.1.4.2.2. Quality of service comprises the two aspects of signal (voice or data) quality and availability. Signal quality can be defined by signal to noise ratio or SINAD for analogue systems and by bit error ratio for digital systems. The availability can be defined in terms of a percentage of time and location.

4.1.4.2.3. Specified quality of service shall be provided within the radio service area appropriate to the services being provided.

4.1.4.2.4. The service provider will demonstrate that the defined quality of service and any other conditions associated with the frequency assignment have been met within the radio service area.

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4.1.4.2.5. Recommendation: The Radio Service Area should be published to provide aviation users with information on the anticipated service volume within which reliable communications may be expected. Where the communications quality of service cannot easily be achieved uniformly over the service volume at the lower height limit of the Radio Service Area, an alternative is to publish the DOC and to identify areas within which the quality of service is not achieved.

4.1.4.3 Equipment Configuration

4.1.4.3.1. The configuration of equipment includes associated antennas, cables, filters, commutation units, switching circuits, speech circuits and other equipment necessary for the operation of the equipment and systems.

4.1.4.3.2. The equipment configuration shall be such as to ensure the availability of communications appropriate to the service being provided (main and emergency equipment).

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4.1.4.3.3. Wherever a service is provided using main equipment only, it shall be explicitly shown how the risks of ATS radiotelephony failure have been adequately mitigated, taking account of: the local airspace environment, specific ATS task, aircraft characteristics and needs and flight crew procedures. Where appropriate mitigation cannot be demonstrated, it is expected that emergency radiotelephony equipment and/or additional contingency equipment will be provided.

4.1.4.3.4. It shall also be clearly demonstrated how services will be managed during periods of planned withdrawal of single systems to provide for such things as periodic maintenance.

4.1.4.4 Duty Cycle - Radio Transmitters/Power Supply Units

4.1.4.4.1. The duty cycle for Radio Transmitters and associated Power Supply Units shall be appropriate for the service being provided.

4.1.4.4.2. Guidance: ATC Services are likely to generate peaks in use which may exceed the duty cycle of equipment rated for intermittent use and thus continuously rated equipment with a duty cycle of 100% is likely to be required. VHF Radio Transmitters used for ATIS and VOLMET obviously require continuously rated equipment.

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4.1.4.5 Power Supply

- 4.1.4.5.1. The power supply for emergency equipment shall be independent of that for the main equipment.
- 4.1.4.5.2. Users shall be provided with an indication of failure of the power supply to the emergency equipment and instructions shall be provided for user actions in the event of failure.
- 4.1.4.5.3. Guidance: The incorporation of suitable conditioning devices as part of the power supply arrangements may be useful in preventing equipment malfunction due to surges, spikes and noise on the power supply.
- 4.1.4.5.4. Recommendation: For an ATC and Service a primary and alternative power supply should be provided to increase the availability of power to equipment and systems in the event of an interruption to one of the power supplies. Change over between supplies should be on a 'no break' basis. The primary and alternative supplies should be independent of each other for a known period of time. An indication of failure for each power supply should be provided to the user and corrective action taken in the event of failure. [ICAO Annex 10 Aeronautical Telecommunications Volume I Paragraph 2.9 Secondary power supply for radio navigation aids and communication systems.]

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4.1.4.6 Alarm/Status Indications

4.1.4.6.1. The system shall provide an indication of system failure that may have an effect on the service being provided, in a timely manner, so that actions can be taken to ensure the safe continued provision, or if necessary, the controlled withdrawal of the service.

4.1.4.6.2. The failure indication should remain obvious to the user whilst the condition causing the failure indication remains. Consideration should be given to providing a power supply to the alarm indication that is not dependent upon the system it is monitoring.

4.1.4.6.3. The attention seeking indication should have both visual and audible elements and the ability for the user to acknowledge that they are aware of the change of state thereby removing the attention seeking element.

4.1.4.7 Interface to Voice/Data Recording Equipment

4.1.4.7.1. The system at Aeronautical Radio Stations shall provide all the necessary signals and information to the Voice/Data Recording Equipment.

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4.1.4.7.2. Acceptable Means of Compliance: For Aeronautical Radio Stations using a separate transmitter and receiver, the receiver audio output may be used as the signal source for the recording equipment. For Aeronautical Radio Stations using a transceiver, a separate receiver on the same frequency will be required.

4.1.4.7.3. If a separate receiver is used to record aircraft station transmissions, the antenna and receiver combination must provide a signal comparable in strength and reception area to that of the main antenna and transceiver.

4.1.4.8 Unintentional or Continuous Transmissions

4.1.4.8.1. The equipment and systems at Aeronautical Radio Stations shall not fail in a manner such as to cause unintentional or continuous transmissions.

4.1.4.8.2. Recommendation: New equipment and systems at Aeronautical Radio Stations should incorporate features to prevent unintentional or continuous transmissions, unless this is contrary to the intended purpose for which they have been designed. For existing equipment and systems, consideration should be given to incorporating such devices by retrofit, modification or add-on circuitry where appropriate.

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4.2. Maintenance of Aeronautical Radio Stations

4.2.1. General Requirements

- 4.2.1.1 Maintenance arrangements shall be established to ensure the continued availability and reliability of all radio facilities, including fixed base, hand-held and mobile equipment at an Aeronautical Radio Station associated with the provision of an ATC service.
- 4.2.1.2 All the technicians will be properly trained on the radio equipment.
- 4.2.1.3 A record of any functional test, flight checks and particulars of any maintenance, repair, overhaul, replacement or modification shall be kept in respect of the equipment and systems at Aeronautical Radio Stations, as or a period of two years.
- 4.2.1.4 Provision is made in the certificates for a record of an individual's proficiency. This may be used to record how often an individual performs maintenance duties on specific equipment and/or lapses in competency on specific equipment.

4.2.2. Training

- 4.2.2.1 A training program ensuring that the employees shall execute their positions and the activities laid upon them in an appropriate professional level according to the service provider procedures;
- 4.2.2.2 The training will be according to ICAO Doc 9712
- 4.2.2.3 The training program is accepted by the CAAI
- 4.2.2.4 The training program shall include separate parts according to these details:
 - 4.2.2.4.1. Initial training;
 - 4.2.2.4.2. Periodic training;
 - 4.2.2.4.3. Special training;
 - 4.2.2.4.4. Human factor training;
 - 4.2.2.4.5. Work safety;

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4.2.3. Maintenance program

- 4.2.3.1 A maintenance program is the source of scheduled inspections, relevant controls and supporting data. The Maintenance Program should always be active (subject to review and amendment) and utilized such as to enable effective maintenance to be carried out in a logical, concise, clear and controllable manner.
- 4.2.3.2 The CAAI approval of the Maintenance Program provides a mechanism to record minimum standards that the service provider must comply with.
- 4.2.3.3 The maintenance program may be applicable to more than one Radio Stations of the same type.
- 4.2.3.4 The inspector will review the maintenance program according to applicable supporting information provided by the service provider.
- 4.2.3.5 The maintenance program will be design to meet Human Factors principles.
- 4.2.3.6 Consideration should be given to routinely monitoring equipment at adverse weather conditions (i.e. salt laden atmosphere, high humidity, extreme heat etc). These considerations should include increasing maintenance inputs for cleaning, lubrication and inspection of protective finishes as an example.
- 4.2.3.7 The maintenance program should include:
- 4.2.3.7.1. Preface that include the following:
- The type/model of the equipment and, where applicable, power systems.
 - A list of the manuals (reference, revision numbers) that were used to prepare the maintenance manual (supporting information).

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- A statement signed by the service provider accountable manager that:
 - The specified equipment will be maintained according to the maintenance program; and
 - The program will be reviewed and updated as required; and
 - Practices and procedures to satisfy the maintenance program will be to the standards specified in the manufacture Maintenance Instructions. In the case of approved practices and procedures that differ, the statement should refer to them.

4.2.3.7.2. List of scheduled inspections that include for each task the following information:

- Task description
- Interval
- Reference to manufacturer manual or other supporting information.
- Skill of technician – if required.
- Applicability – if the maintenance program is used for more than one facility.

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- List of items with life limitation (including the life limitation for each item).

4.2.3.7.3. Forms

- All the forms/log books that are going to be used will be part of the maintenance program.

4.2.3.7.4. Additional procedures if required

4.2.3.7.5. Permitted variations to maintenance periods

4.3. Additional information

The inspector will review all the other documents required by CAAI AP 1.7.005 / 2.7.005 (ATS equipment installation, maintenance, operation & approval)

4.4. Demonstration and Inspection Phase

- 4.4.1. CAAI requires service providers to demonstrate their ability to comply with regulations and safe operating practices before issuing approval to the ATS equipment.
- 4.4.2. These demonstrations include actual performance of activities and/or operations while being observed by the inspector.
- 4.4.3. The demonstration will include on-site evaluations of equipment maintenance and support facilities.
- 4.4.4. During these demonstrations and inspections, the inspector will evaluate the effectiveness of the policies, methods, procedures, and instructions as described in the Service provider manuals and other documents.
- 4.4.5. Deficiencies will be brought to the attention of the service provider and corrective action must be taken before an approval is issued.

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5. Task Outcomes

- 5.1. After the document compliance and the demonstration and inspection phases have been completed satisfactorily, the inspector will prepare the Aeronautical Telecommunication Service Certificate that include all the information (equipment model, frequencies, identification, location, limitations etc..).
- 5.2. The service provider must acknowledge receipt of these documents.
- 5.3. The process above should be documented in the Sharedocs system.